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A Methodology to Develop Entrepreneurial Networks: The Tech Ecosystem of Six African Cities

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Our project introductory paper, "Network Models of Entrepreneurial Ecosystems in Developing Economies," describes our team's research goal of quantifying an influence network in this case, a local entrepreneurial ecosystem, in such a way that the analysis empowers decision-makers with the requisite knowledge to develop specific policy recommendations.

This paper describes our team's modification of the Position Generator methodology developed by sociologists at the University of Groeningen (Van der Gaag et al 2008). This methodology enables us to accurately measure social capital and circumvents the massive effort of mapping an individual's social network before locating the social resources in it.

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Background

Our project introductory paper, "Network Models of Entrepreneurial Ecosystems in Developing Economies," describes our team's research goal of quantifying an influence network in this case, a local entrepreneurial ecosystem, in such a way that the analysis empowers decision-makers with the requisite knowledge to develop specific policy recommendations.

This paper describes our team's modification of the Position Generator methodology developed by sociologists at the University of Groeningen (Van der Gaag et al 2008). This methodology enables us to accurately measure social capital and circumvents the massive effort of mapping an individual's social network before locating the social resources in it. By approaching the entrepreneur's network through the analysis of his connections to prominent structural roles in the community or society, we are able to construct models that can determine the influence of each role in specific entrepreneurial environments. The actual data collected during this study is analyzed in subsequent papers.

Network Analysis and Influence Networks

Sociologists, economists, and network scientists concur that the entrepreneur's network, or specifically the people and organizations they interact with, are essential to his or her ability to identify and evaluate new business opportunities, access vital resources, and succeed economically (Johannisson 1988). These practitioners have consistently struggled with developing models that are measurable or quantifiable. Most research on this subject tends to focus on the entrepreneur's social network and utilizes the Name Generator approach to develop the social network model (McAllister and Fischer 1978). This method maps an ego-centric network and assembles an inventory of information about every social contact, such as the relationship between the person under analysis and the people within the social network.

The Name Generator approach creates numerous challenges. First, the person under analysis might be hesitant to provide names. Additionally, in many cultures, spelling may be an issue and the use of nicknames or numerous surnames make it challenging to determine the true identity of members of the networks. Finally, a member of the network may leave the network for numerous reasons but the role they serve in the network remains filled by another individual. Because of these issues, our team has determined that the Name Generator approach to network development is not appropriate in order to achieve our research goals.

Data Collection

In order to effectively develop and test our methodology, the team quickly realized that it would have to focus on a fairly narrow sub-set of entrepreneurship. Based on relationships we have fostered as a result of our previous research work, the team decided to focus on the Information and Communications Technology (ICT- hereafter referred to as "Tech") sector in Sub-Saharan Africa. We selected this sector as well as our data collection sites based on relationships we have fostered as a result of our previous research work. Two of the most important relationships include:

1. Jon Gosier: a software developer and designer working at the intersection of open data, human rights, and African development. Jon is the founder or co-founder of several organizations and initiatives, some of which include AfriLabs, Appfrica, and Hive Colab in Kampala. AfriLabs is pan-African group of technology and innovation hubs promoting the growth and development of the African technology sector. The AfriLabs network is comprised of 26 hubs and labs across the African continent. Jon agreed to cooperate on the project and the members of the Afrilabs community have been gracious and hospitable hosts.

2. Ben White: Co-Founder and Community Evangelist for VC4Africa. VC4Africa is a web-based platform for startup funding and is the largest online community of entrepreneurs and investors dedicated to building game changing companies on the continent. Ben has been working in the African technology and media space since 2003. Ben is a founding member of AfriLabs and is on the board of advisors to ActivSpaces, an open collaboration space for the technology and entrepreneurial community in Cameroon. The staff for VC4Africa has been invaluable facilitating introductions and cooperation across the continent.

Through the cooperation of both Jon, Ben, and their extensive networks, we were able to visit the following cities and immerse ourselves into the local tech scene: Kampala, Uganda; Addis Ababa, Ethiopia; Lusaka, Zambia; Monrovia, Liberia; Accra, Ghana; and Dar es Salaam, Tanzania. The team would like to also visit Nairobi, Kenya and Lagos, Nigeria but unfortunately, our sponsors cannot allow this due to security concerns. Specific

details concerning the data collections are described in the paper, "'Who do you know?' Developing and Analyzing Entrepreneur Networks: Data Collection in the Tech Entrepreneurial Environment of Six African Cities"

Position Generator Survey

In order to collect the necessary data, the team has developed a six-question survey that gathers some basic demographic data yet keeps the respondent's identity anonymous. The survey analyzes six different focus areas in the network:

1. Business Registration
2. Start-Up Capital
3. Equipment
4. Legal Issues
5. Infrastructure
6. Human Resources

The six questions are similarly structured. The questions ask the position or role the subject would most likely approach in order to get assistance with one of the focus areas. For example, the first question asks:

> "If you require assistance with **the legal registration** of your business, who would you approach first in order to address this issue?"

Each of the questions has the same set of possible responses:

1. Myself
2. Government Representative
3. Government Business Development Program
4. Incubator
5. Non-Governmental Organization
6. Local Investor
7. Family Member
8. Religious Leader
9. Someone in Social Network
10. Commercial Bank
11. White Collar Professional
12. Military Leader
13. Education Leader

Six Focus Areas

Based on the team's previous exploration of the challenges faced by entrepreneurs in Accra, Ghana, and detailed in a previous paper, "Investigating the Small and Medium Enterprise Landscape of Accra, Ghana: Prospects and Barriers to Economic Development," we developed six areas that are vital to entrepreneurial success. We are especially interested in understanding how aspiring entrepreneurs utilize their social capital in order to gain access to these required resources.

1. Business Registration-This is the first step on the entrepreneurial path. Registering a business can be a formidable challenge, even in the Developed World. In the Developing World, many of the required processes are still "manual" and the embedded bureaucracy can be very intimidating. How do local entrepreneurs successfully jump this initial hurdle?
2. Start-Up Capital-Access to initial financing is also a challenge in all environments. Because of the risk adverse environment in much of the Developing World, small business loans are almost impossible to obtain and micro-financing products are a viable option for small consumer goods sellers but the terms are very unattractive for firms that require more patient capital. How do local entrepreneurs access the required capital to launch a business?
3. Equipment-Access to equipment necessary for the business can be a challenge in many environments around the world especially for entrepreneurs aspiring to enter the tech sector. How do local entrepreneurs find the equipment required to launch their business?
4. Legal Issues-All entrepreneurs need access to advice on business formation, business development, contract development, intellectual property, and agreement enforcement. How do local entrepreneurs access the requisite expertise to be successful?
5. Infrastructure-In the Developing World, finding a space in which to operate that has characteristics such as security, back-up power, and internet access can be challenging. How do local entrepreneurs find a work space that allows the business to flourish and grow?
6. Human Resources-Entrepreneurs need to be able to access the Human Capital required to successfully build and grow their business. How do local entrepreneurs find people with the requisite skills?

Responses

Based on the lessons learned from the aforementioned Accra visit, we developed a set of twelve standardized responses to each question. We thought that this would eliminate any possible ambiguity and more importantly, with a standard group of responses, all of our network models would consist of the same number of nodes. By

standardizing nodes we can more confidently compare the network models that we develop. Comparing network models consisting of various numbers of nodes can be challenging from a quantitative perspective. During our first data collection visit in Uganda, we had several respondents answer that a university professor provided assistance with acquiring required resources, so we added Education Leader as an additional possible answer. The definitions of the possible responses are as follows:

1. Myself- The respondent can gain access to the required resource without any assistance.
2. Government Representative- A representative from any level of Government can assist with access to the required resource.
3. Government Business Development Program- A Government Program exists that can assist with access to the required resource. The team decided that we would separate Government Business Development Programs from Incubators sponsored by corporations or impact investors in order to differentiate between ecosystems that have a greater central government involvement than others.
4. Incubator- An Incubator exists that can assist with access to the required resource. We considered Incubators to be traditional business incubators, accelerators, or tech hubs. In some places that we visited, the entrepreneurial environment was not mature enough to support a traditional incubator model and the organizations tended to be a gathering spot for tech entrepreneurs and tech enthusiasts.
5. Non-Governmental Organization (NGO)- Any number of NGOs can assist with access to the required resource.
6. Local Investor- Any local Angel Investor or Venture Capitalist that can assist with access to the required resource.
7. Family Member- An immediate family member who can assist with access to the required resource.
8. Religious Leader- A local minister or other religious member who can assist with access to the required resource.
9. Someone in Social Network- Someone beyond an immediate family member, in network of friends, or a connection on social media who can assist with access to the required resource.
10. Commercial Bank- A staff member at a bank who can assist with access to the required resource.
11. White Collar Professional- White Collar Professionals were defined as attorneys, accountants, brokers, and anyone providing professional services who can can assist with access to the required resource.
12. Military Leader- Any member of the military who can assist with access to the required resource.
13. Education Leader- A University Professor or any other leader in the education sector who can assist with access to the required resource.

Analysis Methodology

Over the course of six visits, we were able to interview 266 local entrepreneurs. Based on their answers to the survey at each location, we developed a matrix like the one depicted in Table 1 that captures the number of times that each entrepreneur answered a specific role to one of the six survey questions. Table 1 is the raw data from our first data collection trip to Kampala, Uganda.

	Self	Govt Rep	Govt Biz Dev	Incubator	NGO	VC/Angel	Family	Religious	Social Network	Bank	Prof	Military	Education
1	3	0	0	1	0	0	0	0	2	0	0	0	0
2	0	0	0	4	0	0	1	0	1	0	0	0	0
3	0	0	0	0	0	1	0	0	2	0	3	0	0
4	0	1	0	1	0	0	2	0	1	0	1	0	0
5	0	1	0	0	0	0	2	0	2	0	1	0	0
6	0	0	0	1	0	0	1	0	3	0	1	0	0
7	1	1	1	0	0	1	1	0	0	1	0	0	0
8	1	0	0	1	0	0	1	0	1	0	2	0	0
9	1	0	0	0	0	0	2	0	1	0	1	0	1
10	1	1	0	1	0	0	1	0	1	0	1	0	0
11	0	0	1	0	0	1	0	0	2	1	1	0	0
12	3	0	0	0	0	1	0	0	0	0	2	0	0
13	1	0	0	0	0	0	2	0	2	0	1	0	0
14	2	0	2	0	0	2	0	0	0	0	0	0	0
15	1	0	0	0	0	1	0	0	4	0	0	0	0
16	2	0	0	0	0	0	1	0	1	0	2	0	0
17	2	0	0	0	0	0	0	0	4	0	0	0	0
18	1	0	0	1	0	1	1	0	1	0	1	0	0
19	2	0	0	1	0	1	0	0	0	0	2	0	0
20	2	0	0	0	0	0	1	0	0	0	3	0	0
21	3	0	0	1	0	0	0	0	1	0	1	0	0
22	2	0	1	0	0	0	0	0	2	0	1	0	0
23	1	0	0	0	0	0	0	0	3	0	2	0	0
24	1	0	0	0	0	0	0	0	0	1	4	0	0
25	0	0	0	0	0	1	0	0	5	0	0	0	0
26	0	0	0	0	0	1	0	0	5	0	0	0	0
27	0	0	0	0	2	0	0	0	3	0	2	0	0
28	2	0	0	0	1	0	0	0	1	0	2	0	0
29	1	0	0	0	1	1	0	0	3	0	0	0	0
30	1	0	1	0	0	1	0	0	2	0	1	0	0
31	1	0	0	1	0	2	0	0	0	0	2	0	0
32	3	0	0	0	0	0	1	0	1	0	1	0	0
33	3	0	0	0	0	0	1	0	1	0	1	0	0
34	2	0	1	0	1	0	0	0	2	0	0	0	0
35	1	1	0	1	0	0	2	0	0	0	0	0	1
36	1	0	0	0	0	0	0	0	4	0	1	0	0
37	2	0	0	0	0	0	0	0	3	0	1	0	0
38	1	0	0	0	0	0	2	0	2	0	1	0	0
39	0	0	0	0	0	0	0	0	6	0	0	0	0

Table 1-Example Raw data (Kampala, Uganda)

Based on this collected data, we developed an initial network model (Figure 1) that illustrates how the respondents are connected to each of the roles in the network. While the resulting network model is interesting, it alone but does not immediately present the necessary insights to a policy maker. The ability to understand the influence that each role possesses and its relationship to other roles in the entrepreneurial network is vital to effective policy making. Fortunately, network analysis techniques allow us to quantify this influence.

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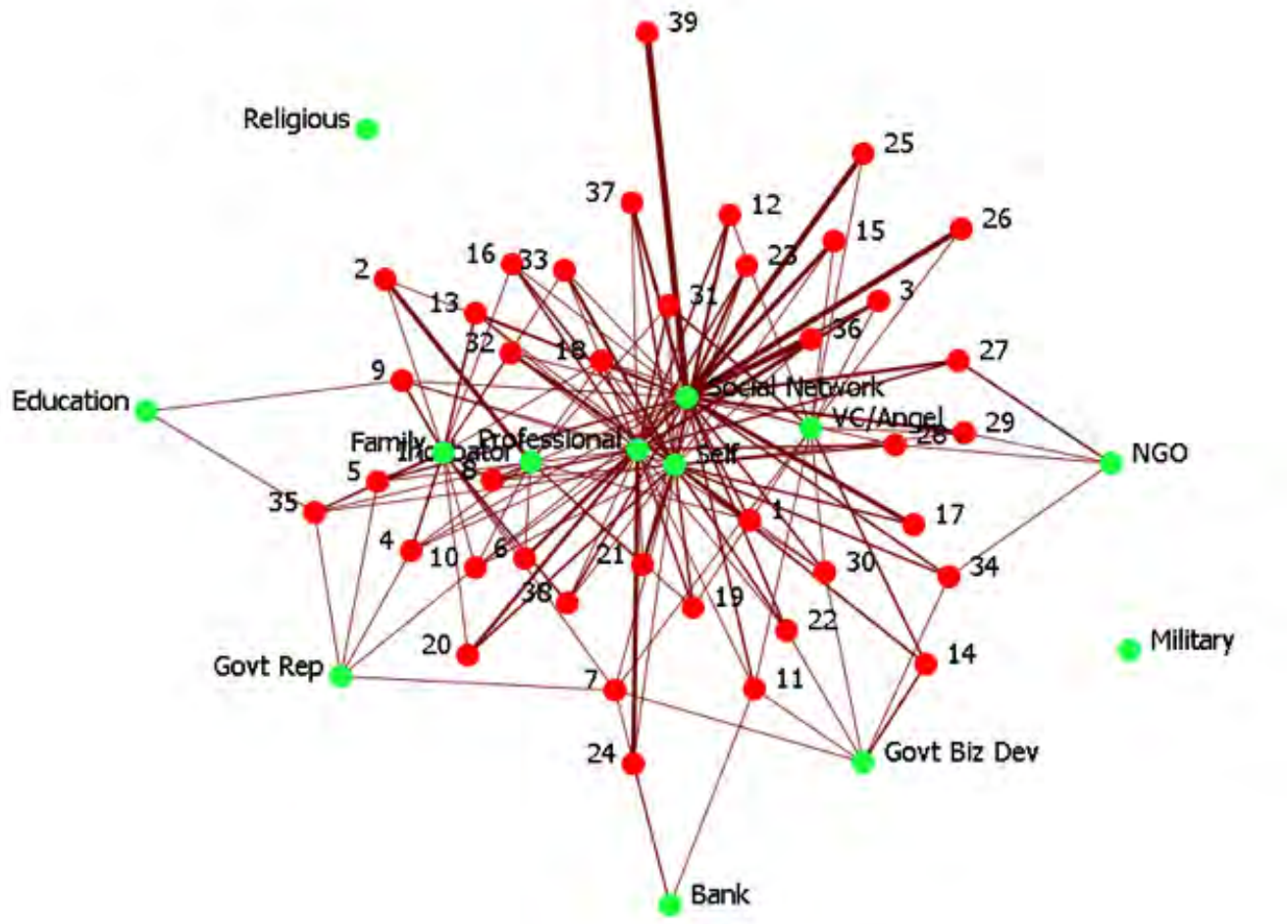

Figure 1: Example Initial Network (Kampala, Uganda). Red nodes are the survey respondents and green nodes are the possible survey responses. The links between the respondents and the responses visualize the roles that give the respondents access to required resources.

A technique commonly referred to as “data folding” uses matrix algebra techniques to enable us to infer both influence and relationships of the roles in this particular network. This technique takes the original two-mode network (survey respondents and roles) and converts it to a single-mode network. In this case, it illustrates how the roles are connected through the respondents and captures the weighting of the number of times that the respondent answers a survey question citing a specific role.

	Self	Govt Rep	Govt Biz Dev	Incubator	NGO	VC/Angel	Family	Religious	Social Network	Bank	Prof	Military	Education
Self	0	3	10	13	5	16	22	0	65	2	54	0	2
Govt Rep	3	0	1	3	0	1	8	0	4	1	3	0	1
Govt Biz Dev	10	1	0	0	1	7	1	0	8	2	3	0	0
Incubator	13	3	0	0	0	4	12	0	14	0	11	0	1
NGO	5	0	1	0	0	1	0	0	12	0	6	0	0
VC/Angel	16	1	7	4	1	0	2	0	24	2	14	0	0
Family	22	8	1	12	0	2	0	0	26	1	22	0	4
Religious	0	0	0	0	0	0	0	0	0	0	0	0	0
Social Network	65	4	8	14	12	24	26	0	0	2	53	0	1
Bank	2	1	2	0	0	2	1	0	2	0	5	0	0
Professional	54	3	3	11	6	14	22	0	53	5	0	0	1
Military	0	0	0	0	0	0	0	0	0	0	0	0	0
Education	2	1	0	1	0	0	4	0	1	0	1	0	0

Table 2-Example Role x Role Matrix (Kampala, Uganda)

Based on this resulting matrix, we can now develop the following network model:

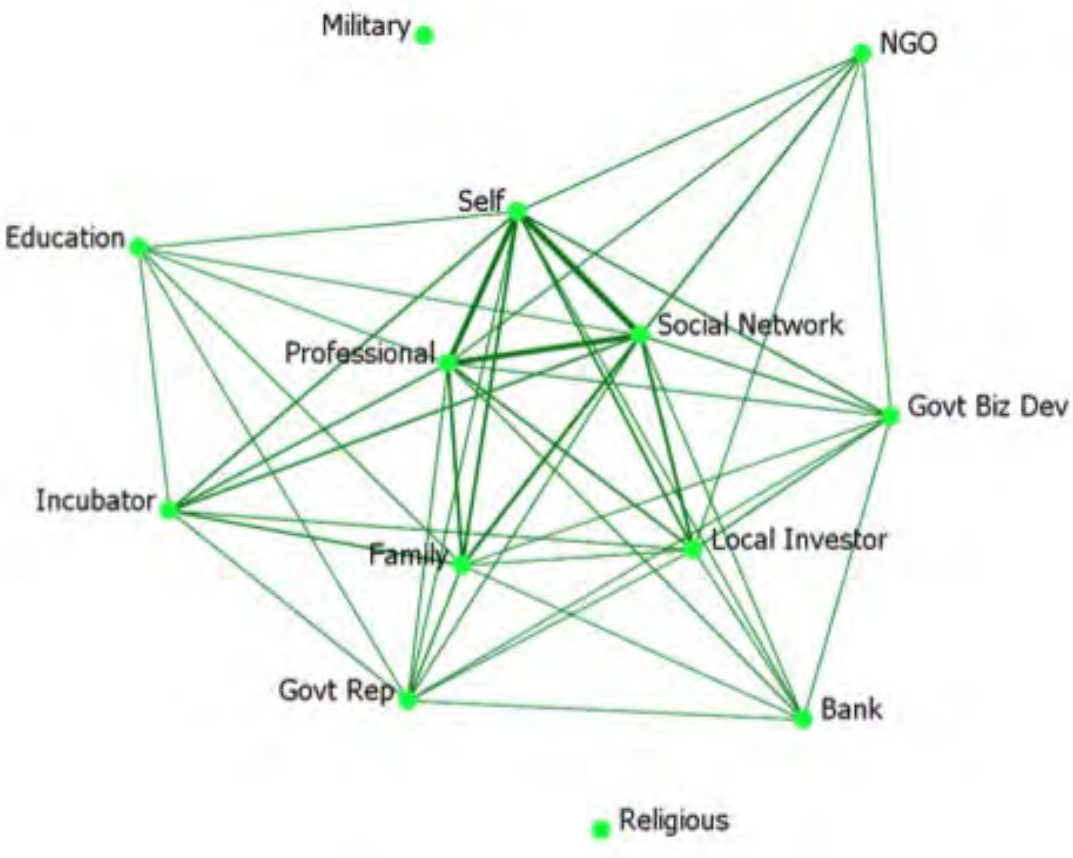

Figure 2: Example Role x Role Network Model
Kampala Entrepreneurial Ecosystem

The links in Figure 2 are weighted based on the strength of the connection between the nodes. A visual inspection of the network model illustrates the importance of several roles in the network. For instance, Social Network, Professional, Self, Family, and VC/Angel are very central (in this particular case, we used weighted degree centrality) in the network. Interestingly, both Military and Religion are not connected to the network, indicating that these roles are not influential in the Kampala entrepreneurial environment.

Conclusion

This paper introduces our team's analytical methodology and illustrates an example of network development. A follow-on paper will introduce all six network models we have developed from the data collection visits and will present an initial descriptive analysis of these network models. Additional papers will introduce methodologies to classify these network models enabling us to compare and contrast them. After developing the classification methodology, we will explore the identification of "driver nodes." By influencing these nodes, or their links to other nodes, we will generate specific policy recommendations for each network based on its own specific mathematical characteristics.

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